example, highly toxic contaminated material could be treated so that the concentrations of hazardous constituents, while still above media cleanup levels, would support a reliable containment remedy.

The exact balance between reduction in toxicity, mobility or volume and exposure control will best be established on a case-by-case basis in consideration of site-specific conditions; however, all things being equal, permanent reductions in toxicity, mobility or volume are preferred to exposure control because it is protective of human health and the environment in the long-term and removes the risks associated with the potential failure of engineering or institutional controls. Program implementors and facility owners/operators are cautioned against too great a reliance on exposure control remedies when alternatives which include permanent reduction in toxicity, mobility or volume are available, affordable and practical. Additional information on the balance between toxicity reduction and exposure control is available in ''A Guide to Principal Threat and Low Level Threat Wastes,'' Superfund Publication 9380.3–06FS, November 1991, which is available in the docket for today's Notice.

b. Remedy Selection Criteria. The 1990 proposal, like the Superfund NCP, established a two-phased evaluation for remedy selection. During the first phase, potential remedies are screened to see if they meet ''threshold criteria''; remedies which meet the threshold criteria are then evaluated using various ''balancing criteria'' to identify the remedy that provides the best relative combination of attributes. While the CERCLA remedy selection criteria are not identical to the RCRA corrective action criteria proposed in 1990, they address the same types of considerations and should generally result in similar remedies when applied to similar site-specific conditions.

The 1990 proposal identified four remedy threshold criteria and five balancing criteria. The four threshold criteria proposed in 1990 were that all remedies must: (1) be protective of human health and the environment; (2) attain media cleanup standards; (3) control the source(s) of releases so as to reduce or eliminate, to the extent practicable, further releases of hazardous waste (including hazardous constituents) that might pose threats to human health and the environment; and (4) comply with applicable standards for waste management. EPA believes these threshold criteria remain appropriate as general goals for cleanup and screening tools for potential remedies.

There has been some confusion regarding the proposed threshold criterion that remedies attain media cleanup standards. Attaining media cleanup standards does not necessarily entail removal or treatment of all contaminated material above specific constituent concentrations. Depending on the site-specific circumstances, remedies may attain media cleanup standards through various combinations of removal, treatment, engineering and institutional controls. For example, in situations where waste is left in place in an engineered landfill or under a cap, media cleanup standards would be attained, in part, through long-term engineering and institutional controls.

The 1990 proposal identified five balancing criteria for choosing among remedies that meet the threshold criteria. The five balancing criteria proposed in 1990 were: (1) Long-term reliability and effectiveness; (2) reduction of toxicity, mobility or volume of wastes; (3) short-term effectiveness; (4) implementability; and (5) cost. The balancing criteria were not ranked in terms of relative importance. As discussed in the 1990 proposal, any one of the balancing criteria might prove to be the most important at a particular site. For example, a remedy at a certain site might be protective in the short term but not necessarily reliable in the long term (e.g., capping of a highly contaminated area). In this case, the need for long term reliability and the potential for long-term operation and maintenance costs would tend to point toward a remedy which presented a more advantageous combination of the balancing criteria (e.g., removal or treatment of hot spots, capping residual contamination, and implementing an institutional control).

The proposed balancing criterion of cost has caused some confusion. Cost can and should be considered when choosing among remedies which meet the threshold criteria. As discussed in the 1990 proposal, EPA believes that many potential remedies will meet all the threshold criteria. In that situation, cost becomes an important consideration in choosing the remedy which most appropriately addresses the circumstances at the facility and provides the most efficient use of Agency and facility owner/operator resources. For cost comparisons between alternatives to be accurate, they should include capital and operation and maintenance costs for the anticipated life of the remedy.

Pending resolution of the 1990 proposal, program implementors and facility owners/operators should use the threshold and balancing criteria proposed in 1990 as guidance when selecting facility-specific remedies; however, as discussed in Section V of today's Notice, EPA is also considering and requesting comment on a number of alternatives for corrective action remedy selection, including focusing on remedy performance standards. These alternatives are based, in part, on innovative approaches already used in some states and EPA Regions.

c. Media Cleanup Standards. The term ''media cleanup standards'' typically refers to broad cleanup objectives; it often includes the more specific concepts of ''media cleanup levels,'' ''points of compliance,'' and ''compliance time frames.'' The more specific term, ''media cleanup levels'' typically refers to site- and media-specific concentrations of hazardous constituents, developed as part of the overall cleanup standards for a facility. Media cleanup standards (and levels) should reflect the potential risks of the facility and media in question by considering the toxicity of the constituents of concern, exposure pathways, and fate and transport characteristics.

Consistent with the CERCLA program, in the RCRA corrective action program EPA intends to clean up sites in a manner consistent with available, protective, risk-based media cleanup standards (e.g., MCLs and state cleanup standards) or, when such standards do not exist, to clean up to protective media cleanup standards developed for the site in question (e.g., through a site-specific risk assessment). Both approaches require a site-specific risk-based decision. When available media cleanup standards are used (e.g., MCLs, state cleanup standards), the assumptions used to develop the standardized cleanup values should be consistent with the site-specific conditions at the facility in question.

As discussed in the NCP and the 1990 proposal, EPA's risk reduction goal is to reduce the threat from carcinogenic contaminants such that, for any medium, the excess risk of cancer to an individual exposed over a lifetime generally falls within a range from 10^{-6}, in other words, an exposed individual will have an estimated upperbound excess probability of developing cancer of one in one-million, to 10^{-4}, or an exposed individual will have an estimated upperbound excess probability of developing cancer of one in ten-thousand. For non-carcinogens, the hazard index should generally not

exceed one (1).[6] Available risk-based media cleanup standards are considered protective if they achieve a level of risk which falls within the 10^{-6} to 10^{-4} risk range.

EPA's preference, all things being equal, is to select remedies that are at the more protective end of the risk range. Therefore, program implementors and facility owners/operators should generally use 10^{-6} as a point of departure when developing site-specific media cleanup standards. Use of 10^{-6} as a point of departure does not establish a strict presumption that all final cleanups will necessarily attain that level of risk reduction. Given the diversity of the corrective action universe and the emphasis on consideration of site-specific conditions such as exposure, uncertainty, or technical limitations, the Agency expects that other risk reduction goals may be appropriate at many corrective action facilities. As discussed in the 1990 proposal, EPA endorses ''* * * an approach [to remedy selection] that allows a pragmatic and flexible evaluation of potential remedies at a facility while still protecting human health and the environment. This approach emphasizes the overall goal of 10^{-6} as the point of departure, while allowing site or remedy-specific factors, including reasonable foreseeable future uses, to enter into the evaluation of what is appropriate at a given site.'' (See, 55 *FR* 30826.)

d. Points of Compliance. As proposed in 1990, the point of compliance (POC) is the location or locations at which media cleanup levels are achieved. In the absence of final corrective action regulations specifically addressing points of compliance, program implementors and facility owners/operators develop POCs on a site-specific basis. For air releases, program implementors and facility owners/operators have generally used the location of the person most exposed, or other specified point(s) of exposure closer to the source of the release. For surface water, program implementors and facility owners/operators have routinely established the POC at the point at which releases could enter the surface water body; if sediments are affected by releases to surface water, a sediment POC is also established. Points of compliance for soils are generally selected to ensure protection of human and environmental receptors against direct exposure and to take into account protection of other media from cross-media transfer (e.g., via leaching, runoff or airborne emissions) of contaminants. For groundwater, program implementors and facility owners/operators generally set the POC throughout the area of contaminated groundwater or, when waste is left in place, at and beyond the boundary of the waste management area encompassing the original source(s) of groundwater contamination. This approach to the groundwater POC is generally referred to as the ''throughout the plume/unit boundary POC.'' This approach is consistent with the groundwater POC described in the preamble to the Superfund program's National Oil and Hazardous Waste Contingency Plan (NCP, pages 8713 and 8753, Federal Register March 8, 1990). EPA recommends consideration of the following factors when developing a site-specific groundwater POC: proximity of sources of contamination; technical practicability of groundwater remediation; vulnerability of the groundwater and its possible uses; and, exposure and likelihood of exposure and similar considerations.

In 1990, EPA proposed specific POCs for groundwater, air, surface water, and soil. These proposals, especially the proposed POC for groundwater, generated a substantial number of comments. Developing site-specific points of compliance generally continues to be an area of discussion and debate. In Section V.E.2 of today's Notice, EPA requests additional comment regarding POCs for corrective action.

e. Compliance Time Frame. The compliance time frame is the time period and schedule according to which corrective actions are implemented. In the 1990 proposal, EPA expressed a preference for the expeditious stabilization of releases, followed by timely completion of corrective actions and full restoration of contaminated media; however, a number of factors may influence the time frame within which media cleanup standards are attained, including: the extent and nature of contamination at the facility; risks to human health and the environment before and during remedy implementation; practical capabilities of remedial technologies; the availability of treatment or disposal options; and, the desirability of utilizing emerging technologies.

Remedy implementation schedules developed at the time of remedy selection should, to the extent possible, specify the compliance time frame; however EPA recognizes that uncertainties associated with remediation may make it impossible to specify when a remedy must be completed. For example, due to complexities associated with contaminant occurrence in the subsurface and with groundwater remediation in general, the time needed to remediate groundwater at some sites cannot be accurately predicted. In these circumstances, the Agency recommends the use of performance measures or milestones monitored over time to track progress toward attaining remedial goals. These performance measures should be specified in the remedy implementation plans or performance standards. In cases where it is not practical to determine a precise compliance time frame, estimated compliance time frames may be used to help evaluate remedial alternatives and the technical practicability of site-specific remedial goals.

EPA emphasizes that, at many sites, the primary focus should be on near-term stabilization of releases. At these sites, it may be appropriate to focus the compliance time frame and corrective measures implementation schedule on the stabilization action; the remaining compliance time frame and corrective measures implementation schedule (if any are necessary) could then be developed during selection of the facility-wide remedy.

f. Site-Specific Risk Assessments. EPA's strategy for corrective action implementation incorporates risk-based decision-making throughout the corrective action process. At some sites, risk-based decisions can be made using standardized risk considerations, such as standardized exposure assumptions. At other sites, a site-specific risk assessment will be desirable. When a site-specific risk assessment is needed, EPA, in some cases, has directed the facility owner/operator to perform the risk assessment; in other cases EPA has chosen to do the risk assessment itself based on data submitted by the owner/operator. Site-specific risk assessments conducted at RCRA facilities may be based on CERCLA's extensive guidance in this area (e.g., ''Risk Assessment Guidance for Superfund,'' Volumes I and II, Interim final EPA/540/1–89/001 and 002, December 1989 and March 1989). Additional information on the Agency's approach to risk-based decision-making is available in the Agency's recent memorandum on risk characterization. (See, 3/21/95 memorandum from Carol Browner, ''EPA Risk Characterization Program'' in the docket for today's Notice.) The

[6] The hazard index is a measurement of non-carcinogenic risks. It is calculated by summing two or more hazard quotients for multiple substances and/or multiple exposure pathways. A hazard quotient is the ratio of a single substance exposure level over a specified time period to a reference dose for that substance derived from a similar exposure period.